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Laurence Hamid

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EXAMINER

SIANGCHIN, KEVIN

ART UNIT

PAPER NUMBER

2623

DATE MAILED: 09/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/973,011

Applicant(s)

HAMID, LAURENCE

Examiner

Kevin Siangchin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 17-20 is/are rejected.
- 7) ☒ Claim(s) 16 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 October 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6, 10/2001.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Detailed Action

Drawings

Objections

1. The drawings are objected to because of the following. The Applicant refers to a Fig. 7d in the specification (page 18, paragraph [0072] of the Applicant's disclosure). However, no such drawing was submitted. A submission of the missing drawing is required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

Objections

2. The disclosure is objected to because of the following informalities. On page 18 paragraph [0072], the Applicant refers to a Fig. 7d. Fig. 7d does not exist. Appropriate correction is required.

Claims

Rejections Under 35 U.S.C. § 112(2)

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 15 and 17 recite the limitation "the predetermined acquisition parameter". There is insufficient antecedent basis for this limitation in the claim. Notice that, according to parent claim 14, there are different

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acquisition parameters. Therefore, it is not clear as to what predetermined acquisition parameter claims 15 and 17 refer to.

Rejections Under 35 U.S.C. § 112(1)

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claim 9 and 15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. These claims propose storing (or otherwise providing) a plurality of biometric templates associated with the moisture condition of a finger. These templates are subsequently compared to an input image of a fingerprint to verify whether a corresponding template exists. The Applicant should appreciate the fact that the moisture of a fingerprint is highly variable. For example, the fingerprint moisture may be variably distributed when pressure is applied to the platen. The moisture of the finger may even vary during a single scanning session due to, among other things, psycho-physical variations of the user, variations in local humidity, or variations in the applied pressure. Indeed, the moisture of a finger and, moreover, the manner in which that moisture manifests itself in the fingerprint image, is stochastic in nature. Therefore, fingerprint template images obtained from a finger exhibiting different moisture levels (even if a multitude of moisture levels are accommodated) would not provide an accurate means for verifying a fingerprint – *moist and/or dry fingerprints are not a reliable biometric sources*. While stochastic methods of classification utilizing these defective templates could be used for verification, none are disclosed nor could be surmised from the Applicant's specification. The Applicant does not provide an adequate justification of how and why such templates would ever facilitate, or even allow for, the proper and consistent verification of a given fingerprint.

Rejections Under 35 U.S.C. § 102

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7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1-3 and 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Jain et al. (U.S. Patent 6,185,318).

9. *The following is in regard to Claim 1.* Jain et al. discloses a fingerprint recognition method (e.g. Jain et al. Fig. 2) comprising the steps of:

- (1.a.) Acquiring an image of a fingertip (e.g. Jain et al. Fig. 2, step 210).
- (1.b.) Processing the image to determine a value indicative of a predetermined acquisition parameter¹ thereof (e.g. minutia – Jain et al. column 1, line 65) – Jain et al. Fig. 2, feature extraction 220.
- (1.c.) Comparing the image to a stored biometric template (e.g. template(s) 535 of Jain et al. Fig. 5), the comparison process based on the determined value (e.g. minutia – Jain et al. column 6, lines 64-67).
- (1.d.) Performing one of an authentication and a rejection in dependence upon the comparison (e.g. Jain et al. Fig. 2, step 260).

The fingerprint recognition method thus adequately satisfies all limitations of claim 1.

10. *The following is in regard to Claim 2.* As shown above, the method of Jain et al. conforms sufficiently to that of claim 1. Jain et al. further disclose:

- (2.a.) Matching (comparing) input and template fingerprint images according to different sets of criteria or assumptions (Jain et al. column 16, lines 41-44). Suggested criteria or

¹ The term *acquisition parameter* will be taken to mean a physical property or a set of physical properties having values indicating the characteristics or behavior of the fingerprint whose image has been acquired.

assumptions are listed in column 4 of Jain et al. (e.g. items 1-10) and are associated with the detection problems (i.e. items (i)-(vi)) listed in Jain et al. columns 3-4. Each of these rules and/or assumptions are associated with the extracted features of the fingerprint (e.g. downward normal pressure or shear force [Jain et al. column 4, items 3-4 and column 3, item (i)]; spurious or missing minutiae [Jain et al. column 4, items 5-6] or disconnected ridges [Jain et al. column 4, item 10] due to finger dryness or sweat [Jain et al. column 3, item (ii)]). In this manner, the comparison process is selected based on the determined value (i.e. the extracted features).

- (2.b.) The comparison process involves different image processing steps for different determined values. For example, in the case where the finger exerts a different downward normal pressure (Jain et al. column 4, item 3), the matching algorithm compensates distortions by scaling the input and template image appropriately.

In this way, the fingerprint recognition method of Jain et al. conforms the method for fingerprint authentication proposed in claim 2.

11. *The following is in regard to Claim 3.* As shown above, the method of Jain et al. adequately satisfies the limitations of Claim 2. It is well-known that a fingerprint's minutiae are indicative of the unique spatial characteristics of the fingerprint (e.g. shape, orientation, ridge flows, etc.). Furthermore, the information (i.e. a *location* with respect to some predefined coordinate system [Jain et al. column 1, lines 54-56] and an *orientation* [Jain et al. column 1, line 50], as represented by a vector [e.g. vector 105 in Jain et al. Fig. 1B] or angle) associated with the minutiae is inherently numerical. Therefore, minutiae are quantitatively indicative of an "acquisition parameter" (i.e. the unique spatial characteristics) associated with a given fingerprint.

12. *The following is in regard to Claim 6.* As shown above, the method of Jain et al. adequately satisfies the limitations of Claim 1. Furthermore, Jain et al. discloses a comparison process (e.g. feature matching – Jain et al. Fig. 2, step 240 or Fig. 6, step 640) that uses a biometric template (e.g. one of the biometric templates 535 of Jain et al. Fig. 5) selected in dependence upon the determined value (e.g. minutiae). Each fingerprint is assumed to have unique minutiae. Similarly, each template, which are associated with different fingerprints, have different minutiae. Template(s) having minutiae that are sufficiently similar to the minutiae of a given fingerprint, are determined to correspond that fingerprint. This is the entire premise of using minutiae in template-based fingerprint verification. See

Jain et al. column 7, lines 9-17 and column 16, lines 8-13. In this manner, different biometric templates are selected for different determined values.

13. Claims 11 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Bolle et al. (U.S. Patent 6,072,895). To distinguish between other references by Bolle et al. that may be cited in this document, U.S. Patent 6,072,895 will subsequently be referred to as Bolle et al. (895).

14. *The following is in regard to Claim 11.* Bolle et al. (895) discloses a fingerprint recognition method (e.g. Bolle et al. (895) Fig. 6) comprising the steps of:

- (11.a.) Acquiring an image of a fingertip (e.g. Bolle et al. (895) Fig. 6, step 610).
- (11.b.) Processing the image to determine a value indicative of a predetermined acquisition parameter thereof (e.g. average foreground brightness, foreground boundary, orthogonal image contrast, parallel image contrast, feature confidence, distance between two minutia, neighbor information, angle-distance between two minutia, angle-distance neighbor information, minutiae density, ridge length, ridge density, and wiggle factor – Bolle et al. (895) column 5, lines 27-34).
- (11.c.) Selecting an image-processing process (e.g. the various *pruning* processes depicted in Bolle et al. (895) Fig. 7), in dependence upon the determined value (e.g. location and contrast [Bolle et al. (895) Fig. 7, pruning 710], distance and angle [Bolle et al. (895) Fig. 7, pruning 720], distribution [Bolle et al. (895) Fig. 7, pruning 730], or ridge properties [Bolle et al. (895) Fig. 7, pruning 740]). Pruning, as its name implies, removes a subset of features (e.g. spurious or extraneous minutiae or ridges) of the acquired image (Bolle et al. (895) column 3, lines 35-38).

In this manner, the fingerprint recognition method of Bolle et al. (895) conforms to the method that is proposed in claim 11.

15. *The following is in regard to Claim 19.* Bolle et al. (895) discloses a fingerprint recognition system (e.g. Bolle et al. (895) Fig. 6, Abstract sentence 1) comprising:

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- (19.a.) A sensing area for capturing an image of a fingertip presented thereto (Bolle et al. (895) Fig. 5: camera 560, framegrabber 550, and imaging subsystem 580).
- (19.b.) A memory storage area for storing captured images therein (e.g. Bolle et al. (895) Fig. 5, storage 530).
- (19.c.) A processor for executing code thereon to process the captured image (e.g. CPU 515) to:
1. Determine a value indicative of an acquisition parameter thereof (see the discussion above relative to item (11.b.)).
 2. Compare the captured image to a template image (e.g. by *feature matching* – Bolle et al. (895) Fig. 6, step 640) according to an image-processing process (e.g. pruning 710, 720, 730, and/or 740 shown in Bolle et al. (895) Fig. 7) selected in dependence upon the determined value (e.g. location and contrast [Bolle et al. (895) Fig. 7, pruning 710], distance and angle [Bolle et al. (895) Fig. 7, pruning 720], distribution [Bolle et al. (895) Fig. 7, pruning 730], or ridge properties [Bolle et al. (895) Fig. 7, pruning 740]).

In this manner, the fingerprint recognition system of Bolle et al. (895) conforms to the system for fingerprint authentication that is proposed in claim 19.

Rejections Under 35 U.S.C. § 103(a)

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al., in view of Bolle et al. (U.S. Patent 5,995,640). To distinguish between other references by Bolle et al. that may be cited in this document, U.S. Patent 5,995,640 will subsequently be referred to as Bolle et al. (640).

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18. *The following is in regard to Claim 4.* As shown above, the method of Jain et al. adequately satisfies the limitations of Claim 3. As discussed above, Jain et al. suggest matching (comparing) input and template fingerprint images according to different sets of criteria or assumptions (Jain et al. column 16, lines 41-44). These are listed as items 1-4 in Jain et al. column 4. These include an evaluation of the average downward force (i.e. pressure) exerted by the finger (Jain et al. column 4, item 3). Though other suggested criteria include an evaluation of extracted features (e.g. spurious or missing minutiae [Jain et al. column 4, items 5-6] or disconnected ridges [Jain et al. column 4, item 10]) typically related to finger moisture or dryness (see Jain et al. column 3, item (ii)), Jain et al. do not expressly show or suggest evaluating the *moisture condition* of the fingertip (as an "acquisition parameter").

19. Bolle et al. (640) discloses a fingerprint recognition method (Bolle et al. (640) Fig. 2) that evaluates the dryness of a fingerprint (e.g. Bolle et al. (640) Fig. 8, step 880 and Fig. 8B, steps 888-890). *Dryness* represents a *moisture condition* of the fingerprint.

20. One should easily recognize the similarities between the methods of Jain et al. and Bolle et al. (640). Given this, it should be clear that Jain et al. and Bolle et al. (640) are combinable. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, augment the method of Jain et al. to directly evaluate the dryness of a fingerprint as in Bolle et al. (640)'s method. The motivation for doing so would have been to attribute spurious or missing minutiae (Jain et al. column 3, item (ii)) to dryness so that they may be subsequently removed. The result is more robust fingerprint identification. Combining the teachings of Bolle et al. (640) and Jain et al., in this manner, would yield a fingerprint authentication method, with acquisition parameters including both a finger's average downward force (pressure) and a finger's dryness (moisture condition).

21. Claims 5 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. and Bolle et al. (640), as applied above to Claim 4, in further view of Igaki et al. (U.S. Patent 5,109,428).

22. *The following is in regard to Claim 5.* As shown above, the teachings of Jain et al. and Bolle et al. (640) can be combined so as to satisfy the limitations of Claim 4. While it was shown above (see the discussion above relating to Claim 6) that Jain et al. teach the usage of a biometric template selected in dependence upon the determined value, where different biometric templates are selected for different determined values, Jain et al. does not expressly show

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the biometric template selected in dependence upon a determined value of applied finger pressure or fingertip moisture.

23. Igaki et al. disclose a method for fingerprint identification (Igaki et al. Fig. 6), wherein a series of fingerprint template images exhibiting various (and predefined – Igaki et al. column 6, lines 5-8) applied pressures are captured and stored as templates (Igaki et al. column 6, lines 3-8 and lines 14-17). In this manner, each template has associated with it a predetermined applied pressure. These templates are compared with a presented fingerprint (Igaki et al. column 6, lines 52-60) and a “coincident” template is chosen that matches the given fingerprint to a specified level of accuracy. Since these templates directly correspond to various (predefined) degrees of finger pressures, it should be clear that the biometric template is selected in dependence upon a determined value of applied finger pressure.

24. The teachings of Igaki et al. and Jain et al. are combinable because they are analogous art. Specifically, Jain et al. and Igaki et al. disclose analogous fingerprint identification systems and methods. Also, recall that Jain et al. suggest evaluating the fingerprint pressure (i.e. average downward force). Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to select a biometric template based on a “determined value” of applied finger pressure. The motivation for doing so would have been to construct the fingerprint identification method such that it would be able to accommodate fingerprints that may have otherwise been rendered unidentifiable due to distortions resulting from varying applied finger pressures.

25. *The following is in regard to Claim 9.* As shown above, the teachings of Jain et al., Bolle et al. (640) and Igaki et al. can be combined so as to satisfy the limitations of Claim 5. Furthermore, it should be evident from the preceding discussion relating to Claim 5 that Igaki et al. discloses selecting the biometric template from a plurality of biometric templates, each biometric template of the plurality of biometric templates stored in association with an applied pressure of the fingertip.

26. *The following is in regard to Claim 10.* Note that the language of claim 4 (an ascendant of claim 10) – that is, “...the predetermined acquisition parameter is selected from a group *comprising*: a moisture condition of the fingertip and an applied pressure of the fingertip” – essentially lays claim to a predetermined acquisition parameter which may be either: a moisture condition of the fingerprint, an applied pressure of the fingerprint, both a moisture condition of the fingerprint and an applied pressure of the fingerprint, or both a moisture condition of the fingerprint and an applied pressure of the fingerprint and other unspecified acquisition parameters. Seen in this light, the combination of Jain et al., Bolle et al. (640) and Igaki et al. would adequately satisfy the limitations of claim 10. To

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realize this observe that, by selecting the applied pressure as the acquisition parameter (in accordance with claim 4), any further limitations, predicated upon the notion of a moisture-condition acquisition parameter (e.g. the limitations of Claim 10), would become moot. In other words, by selecting the applied pressure of the fingerprint as the acquisition parameter, in accordance with claim 4, biometric templates would be selected based upon a determined value indicative of the fingerprint pressure, according to claim 5. Claim 10 would, therefore, further limit a biometric template selection (based on a moisture condition) that would not occur in the first place. Taking this into account, the teachings of Jain et al., Bolle et al. (640), and Igaki et al., combined as suggested above, would adequately address the limitations of claim 10.

27. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al., Bolle et al. (640), and Igaki et al., as applied above to Claim 5, in further view of Bolle et al. (895).

28. *The following is in regard to Claim 7.* As shown above, the teachings of Jain et al., Bolle et al. (640), and Igaki et al., when combined in the manner suggested above, satisfy the limitations of claim 5. It is well-known that the ridge and valley structures of a fingerprint deform in relation to the downward pressure of the finger. Jain et al. illustrates such a deformation in Jain et al. Fig. 4. These deformations introduce spurious and/or missing minutiae. Furthermore, it is known (Jain et al. column 3, item (ii)) that the moisture (or dryness) of the finger also has the effect of introducing spurious or missing minutiae. Jain et al. Despite this, neither Jain et al., Bolle et al. (640), nor Igaki et al. expressly show or suggest the comparison process including the following steps:

- (7.a.) Selecting an image-processing process in dependence upon the determined value.
- (7.b.) According to the selected image-processing process, processing the image to remove a subset of features contained therein.
- (7.c.) Comparing the processed image to the selected biometric template.
- (7.d.) The biometric template is processed according to a same selected image-processing process prior to being selected for comparison.

29. Bolle et al. (895) discloses a fingerprint recognition method (e.g. Bolle et al. (895) Fig. 6) comprising the steps of:

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- (7.a.) Selecting an image-processing process (e.g. the various *pruning* processes depicted in Bolle et al. (895) Fig. 7) in dependence upon the determined value (e.g. average foreground brightness, foreground boundary, orthogonal image contrast, parallel image contrast, feature confidence, distance between two minutia, neighbor information, angle-distance between two minutia, angle-distance neighbor information, minutiae density, ridge length, ridge density, and wiggle factor – Bolle et al. (895) column 5, lines 27-34).
- (7.b.) According to the selected image-processing process, processing the image to remove (prune) a subset of features (e.g. spurious or extraneous minutiae or ridges) contained therein.
- (7.c.) Comparing the processed image to the selected biometric template (e.g. by *feature matching* – Bolle et al. (895) Fig. 6, step 640).

According to Jain et al. (Jain et al. column 4, items 5-6), spurious minutiae maybe present or genuine minutiae missing from both the input fingerprint and template fingerprint representations. Given this, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to apply the pruning operation of Bolle et al. (895) to both the input fingerprint and template fingerprint representations prior to comparison (item (7.d) above). The motivation for doing so would have been to reduce errors in identification that may be attributable to spurious and/or missing minutiae in either representations. Finally, note that the determined value(s), used by Bolle et al. (895) in the selection of the image-processing process, is indicative of the applied pressure of the finger or the moistness (or dryness) of the finger (Bolle et al. (895) column 2, lines 64-47 and column 3, lines 5-12). This is also indicated in Jain et al. (e.g. Jain et al. column 3, items (i)-(ii)) and Bolle et al. (640) (e.g. Bolle et al. (640) column 3, lines 23-40).

30. The teachings of Bolle et al. (895) are combinable with those of Igaki et al., Jain et al., and Bolle et al. (640) because they are analogous art. Specifically, the teachings of Igaki et al., Jain et al., Bolle et al. (640) and Bolle et al. (640) are all directed toward fingerprint recognition methods and systems. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to incorporate steps (7.a)-(7.d) above into the comparison process. Overall, the motivation for doing so would have been to improve the accuracy of the comparison process by eliminating the artifacts due to finger moisture or applied pressure.

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31. *The following is in regard to Claim 8.* As shown above, the teachings of Jain et al., Bolle et al. (640), and Igaki et al., when combined as suggested above, satisfy the limitations of claim 5. It should be clear that claim 8 puts forth essentially the same limitations as Claim 7 (items (7.a), (7.b), (7.c), and (7.d) correspond to items (c1), (c2), (c4), and (c3) of claim 8, respectively). These subject matter of Claim 8 has, therefore, been adequately addressed in the previous discussion relating to claim 7.

32. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bolle et al. (895), in view of Bolle et al. (U.S. Patent 6,064,753), in further view of Bolle et al. (U.S. Patent 6,005,963). Note that U.S. Patent 6,064,753 and U.S. Patent 6,005,963 will be referred to as Bolle et al. (753) and Bolle et al. (963), respectively.

33. *The following is in regard to Claim 12.* As shown above, the method of Bolle et al. (895) adequately satisfies the limitations of Claim 11. Bolle et al. (895), however, does not expressly show or suggest that the predetermined acquisition parameter is selected from a group comprising a moisture condition of the fingertip and an applied pressure of the fingertip.

34. Bolle et al. (753) discloses a fingerprint recognition method involving an evaluation of the downward force (pressure) applied by the fingertip during acquisition (Bolle et al. (753) column 3, lines 45-48).

35. Bolle et al. (963) discloses a fingerprint recognition method that evaluates the quality of an acquired fingerprint. According to Bolle et al. (963), "[it] is... critical to design an automatic scheme that examines the quality of an acquired fingerprint image before it is processed so that fingerprints with poor quality caused by conditions like partial impressions or poor condition of the finger (too *dry*, too *wet*) can thereafter be identified" (Bolle et al. (963) column 2, lines 44-48).

36. The teachings of Bolle et al. (895), Bolle et al. (753), and Bolle et al. (963) are clearly combinable because the disclosed systems and methods are similar in form and function. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to evaluate the downward force of the fingerprint, as in Bolle et al. (753), and the moisture of the fingertip, as suggested by Bolle et al. (963). As indicated by Bolle et al. (895) (Bolle et al. (895) column 2, lines 64-67 to column 3, lines 1-12), these "acquisition parameters" result in spurious or missing minutiae. It would, therefore, be advantageous to provide some quantitative means for

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determining whether such erroneous minutiae are attributable to these circumstances so that they may be subsequently removed (pruned).

37. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al.

38. *The following is in regard to Claim 13.* Jain et al. discloses a fingerprint recognition method (e.g. Jain et al. Fig. 2) comprising the steps of:

- (13.a.) Acquiring an image of a fingertip (e.g. Jain et al. Fig. 2, step 210).
- (13.b.) Processing the image to determine a value indicative of a predetermined acquisition parameter thereof (e.g. minutia – Jain et al. column 1, line 65) – Jain et al. Fig. 2, feature extraction 220. Jain et al. also suggest an assessment of spurious or missing minutiae that may be associated with finger moisture (Jain et al. column 4, items 5-6, column 3, item (ii), and Jain et al. column 16, lines 19-34), as well as an assessment of the downward force applied by the finger (Jain et al. column 4, lines 3).
- (13.c.) Processing the acquired image according to a predetermined image-processing process (e.g. *feature editing* [Jain et al. Fig. 2, step 230] or *pruning* [Jain et al. column 1, lines 64-67 to column 2, lines 1-10]) to remove a subset of features from the acquired image.
- (13.d.) Selecting (i.e. matching – column 16, lines 9-13) a biometric template in dependence upon the determined value (e.g. minutiae).
- (13.f.) Comparing the processed acquired image to the biometric template (Jain et al. column 16, lines 34-41).
- (13.g.) Performing one of an authentication and a rejection in dependence upon the comparison (e.g. Jain et al. Fig. 2, step 260).

However, the method of Jain et al. does not:

- (13.e.) Process the biometric template according to the predetermined image-processing process, where, in accordance with item (13.c), that process removes a subset of features from the template.

The teachings of Jain et al. are, however, suggestive of this step. Jain et al. suggests that spurious or missing minutiae may afflict both the input and template fingerprint representations (Jain et al. column 4, items 5-6). Jain et al. also suggest that a predetermined image-processing process (e.g. scaling) may be performed on both the input and template fingerprint representations (Jain et al. column 4, item 4). Given this, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to apply feature-editing or pruning to both the input fingerprint representation and the template fingerprint representation. The motivation for doing so would have been to ensure (by their removal) that spurious and/or missing minutiae do not adversely affect the matching procedure.

39. Claims 14 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al, in view of Igaki et al.

40. *The following is in regard to Claim 14.* As shown above, the method of Jain et al. can be modified so as to satisfy the limitations of Claim 13. The method of Jain et al., as disclosed, provides a plurality of biometric template images (e.g. templates 535 depicted in Jain et al. Fig. 5) associated with different acquisition parameters (e.g. the minutiae of different fingerprints). However, each of these biometric templates are not necessarily associated with the same fingerprint.

41. Igaki et al. discloses a fingerprint identification method (Igaki et al. Fig. 6) that provides a plurality of biometric template images of the same fingertip, each biometric template image associated with a different predetermined acquisition parameter (i.e. different applied pressures of the finger). See Igaki et al. column 6, lines 1-17.

42. The teachings of Jain et al. and Igaki et al. are combinable because they are analogous art. In particular, the teachings of Jain et al. and Igaki et al. are both directed toward finger identification methods. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to provide multiple fingerprint templates of the same finger, where each template is associated with a different acquisition parameter (e.g. different minutiae associated with same finger or, as Igaki et al. teach, different applied pressures of

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the finger). The motivation for doing so would have been to provide a degree of redundancy that would reduce so-called *false negatives*².

43. As mentioned previously (see the discussion relating to claim 13), the teachings of Jain et al. suggest the application of the predetermined image-processing process (e.g. feature editing [Jain et al. Fig. 2, step 230] or pruning [Jain et al. column 1, lines 64-67 to column 2, lines 1-10]) to both the input fingerprint image and the template images. Again, the motivation for doing so would have been to eliminate spurious and/or missing minutiae that may obfuscate the matching of the input fingerprint image to the template images.

44. *The following is in regard to Claim 17.* As shown above, the teachings of Jain et al. and Igaki et al. can be combined so as to satisfy the limitations of Claim 14. As mentioned above (see the discussion above relating to claims 14 and claim 5), the method of Igaki et al. uses the applied pressure of a finger as the “acquisition parameter”. (Jain et al. also suggest this – Jain et al. column 4, item 3 – albeit more implicitly). Given this, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to evaluate the applied pressure of the finger, associating it, as Igaki et al. does, with each of stored template images. The motivation for doing so would have been to accommodate fingerprint images obtained at various applied pressures that may have otherwise been rejected due to pressure-related distortions or artifacts.

45. *The following is in regard to Claim 18.* As shown above, the teachings of Jain et al. and Igaki et al. can be combined so as to satisfy the limitations of Claim 17. According to the fingerprint identification method of Igaki et al., biometric templates of a given finger are obtained by:

(18.a.) Placing the fingertip onto a sensing surface using the predetermined applied pressure
(Igaki et al. column 6, lines 1-10).

(18.b.) Capturing an image of the fingertip (Igaki et al. column 6, lines 9-10 and lines 14-17).

This is repeated for various predetermined levels of applied pressure (Igaki et al. column 6, lines 5-10).

46. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bolle et al. (895) et al, in view of Thomopoulos et al. (U.S. Patent 5,978,495).

² False negatives are instances where a valid fingerprint is falsely rejected. By providing multiple templates of a finger in various states or at different instances, one reduces the probability of such false negatives. Conceptually, this probability should be inversely related to the number of templates of a finger, assuming each of the templates correspond to a sufficiently distinguishable state.

47. *The following is in regard to Claim 20.* As shown above, Bolle et al. (895) disclose a fingerprint authentication system that sufficiently conforms to that of claim 19. Bolle et al. (895), does not however expressly show or suggest that the system further include a fingertip-conditioning portion for providing a predetermined fingertip condition to a fingertip placed into contact therewith.

48. Thomopoulos et al. disclose a template-based (Thomopoulos et al. column 11, lines 11 and 16-18) fingerprint authentication system that includes a fingertip-conditioning portion (Thomopoulos et al. Fig. 1, reference number 102) for providing a predetermined fingertip condition to a fingertip placed into contact therewith. See, for example, Thomopoulos et al. Fig. 2, column 3 (lines 2-7), column 4 (item a. and item 3.) and column 5 (lines 34-39).

49. The teachings of Bolle et al. (895) and Thomopoulos et al. are combinable because they are both are directed toward template-based fingerprint authentication. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to incorporate the fingertip conditioning (reference number of Thomopoulos et al. Fig. 2) into the system of Bolle et al. (895). The motivation for doing do would have been to physically treat the finger so as to ensure that a high quality image of the finger can be obtained (Thomopoulos et al. column 9, lines 55-67 to column 10, line 1).

Allowable Subject Matter

Objections, Allowable Subject Matter

50. Claims 15-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 15 must also be rewritten to overcome the rejection(s) under 35 U.S.C. 112, 1st and 2nd paragraphs, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

51. The following is a statement of reasons for the indication of allowable subject matter.

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52. *The following is in regard to Claim 15.* The limitations of claim 15 are, in and of themselves, not allowable. However, when considered in light of its ascendant claims – in particular, claim 14 – the subject matter of claim 15 is allowable. By limiting (as claim 15 does) the acquisition parameter to that of a moisture condition of the fingertip, the plurality of biometric template images of claim 14 are constrained to be strictly in association with different moisture conditions of the fingertip. No prior art was encountered that provided a plurality of biometric images of a same fingertip, each biometric template image associated with a different moisture condition of the fingertip.

53. *The following is in regard to Claim 16.* The allowability of Claim 16 follows directly from its dependence on Claim 15. However, the limitations of claim 16 are not, in and of themselves, allowable. Thomopoulous et al., for example, illustrate the conditioning of the fingertip proposed in claim 16.

Citation of Relevant Prior Art

54. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- [1] *U.S. Patent 6,763,127.* Lin et al. Publication Date: July 2004.

Lin et al. disclose fingerprint recognition method includes iterative gamma correction that *compensates moisture effect*, feature extraction operations, directional morphological filtering that effectively *links broken ridges and breaks smeared ridges*, adaptive image alignment by local minutia matching, global matching by relaxed rigid transform, and statistical matching with Gaussian weighting functions. Note that the Lin et al. uses the same methods of the Applicant to correct artifacts or distortions that arise due to finger moisture.

- [2] *U.S. Patent Application Publication 2002/0036300A1.* Xia et al. Publication Date: November 2001.

Xia et al. disclose a fingerprint recognition system that removes false connections and links disjoint ridges much as Lin et al. Xia et al. do not explicitly attribute these defects to moisture effects, though this could be easily surmised from Xia et al.'s disclosure.

- [3] *U.S. Patent 6,718,052.* Matsumoto et al. Publication Date: April 2004.

Matsumoto et al. disclose a template-based fingerprint verification system that detects (by evaluating the blurriness of an image) and compensates for image defects due to dry or moist fingers.

- [4] *U.S. Patent 5,493,621*. Matsumura et al. Publication Date: February 1996

Matsumura et al. disclose a fingerprint ID system and method, wherein dry and moist fingerprints are detected and the image thereof are corrected (by adjusting contrast). Also pseudo-intersections of ridges due to moisture are eliminated.

- [5] *U.S. Patent 5,963,656*. Bolle et al. Publication Date: October 1999.

A system and method of fingerprint verification related to the others by Bolle et al. cited above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Kevin Siangchin



Examiner
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